BIOLOGICAL METHOD FOR WATER QUALITY CONTROL

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Problem

Saint-Petersburg is located at the Neva river and almost all drinking water for 5 million inhabitants is taken from it. Talking about water supply centralised source for Saint-Petersburg, one can mark a lot of negative factors influencing the water quality. Surely, agricultural pollution, transport and economical problems are among them.

Being a navigable river, Neva can not be secured against all risks connected with the boat traffic and ship accidents and following water contamination. It is necessary to add that in Saint-Petersburg the rain water is flushed into the Neva river without any purification, consequently all pollution from the land transport drains into the water which is later taken for drinking needs. Besides, water pollution affects inhabitants of the Neva river. Neva has a unique ecosytem formed with brakish water species from the Gulf of Finland and fresh water species from the Ladoga Lake. Among them there are some migratory fish species which also have a great commercial value.

Water is not for free. Water consumers pay for the drinking water purification and it works so far as concerns everyman, but some problem appear in respect to the industrial enterprises. According to the principle “polluter pays”, many of them have to pay big taxes for their activities, but in fact they do not.

Biological water quality control

Modern hydrochemical sensor based systems for superficial waters do not allow the simultaneous observation of numerous chemical substances which harmful influence can be unexpectedly dangerous. Besides, these systems can not be used for objective and quick definition of danger degree in change of water composition for native hydrobionts. For that reason we do need to use the biomonitoring methods to define the true level of water toxicity. Now the methods and technical systems based on the the registration of aborigine benthal invertebrates’ biomarkers are being developed for continuous ecological monitoring. The special place is given to identification and study of physiological biomarkers which can be used for conceptual development of automated real time control systems of ecosystem health and status.

The most promising among various methods for water enviroment chemical safety monitoring are those which give an ability to control the water quality by means of functional state (physiological biomarkers) of animal put into the water using the non-invasive registration. This last condition has a special value for water bodies used for the purposes of aquaculture or as a source of centralised water supply. This is exactly the method and adequate bioelectonic system developed several years ago in the laboratory of experimental ecology of aquatic systems (Saint-Petersburg Scientific Research Center for Ecological Safety, Russian Academy of Sciences). This automated system is used for the means of real time water quality control and is based on the non-invasive registration of decapods’ or molluscs’ cardiac activity, referred to as one of the most essential indicators of the animal’s functional status. The analysis of heart rate variability is conducted using the modified variational pulsometry method. This approach allows to investigate influences of chemical substances, in particular toxic ones, on variational pulsometry characteristics, because hitting these substances into waterbodies or in water supply network can harm ecosystem and/or population health.